Teacher Opportunities to Promote Science (TOPS)

Program Description

Teacher Opportunities to Promote Science (TOPS) was a three-year teacher enhancement program conducted by the Education Program Office at Los Alamos National Laboratory for northern New Mexico science, math, and technology teachers and funded by the Department of Energy/Defense Programs. The primary program goal of TOPS was to increase teacher knowledge and skills in the physical sciences, while promoting curriculum alignment and communication through computer networking. Each cohort of TOPS teachers participated in ten meetings and workshops: one two-day orientation at the Laboratory; three two-week summer institutes at the Laboratory; and three two-day regional workshops per academic year (six workshops, in all). Participants received ongoing instruction, tuition assistance, classroom materials and equipment, stipends, and grants, while enjoying interactions with Laboratory education specialists and scientists.

Participants representing all three levels of instruction—elementary (K–5), middle (6–8), and high school (9–12)—formed teams to develop spiral curricula that were inquiry- and constructivist-based and that integrated math, science, and technology. Laboratory scientists and educators acted as mentors on curriculum projects tied directly to ongoing Laboratory areas of scientific research. TOPS teachers learned the skills to develop and post their projects on Websites, thus making the projects available to anyone with Internet access.

As an additional benefit to the participants, the program, in collaboration with the College of Santa Fe-Albuquerque, offered eight 400- and 500- level, three-hour courses in its departments of science and education that could only be taken through participation in TOPS. In March 1999, the New Mexico State Department of Education approved these 24 hours as fulfillment of the requirements to add a science endorsement to secondary New Mexico Teaching Licenses. This option was pursued by 74% of the 1999–2001 TOPS cohort.

Performance Objective and Milestones

The future of the Laboratory depends in part on how well science is taught in northern New Mexico K–12 classrooms for several reasons. One, the Laboratory employees' children are most likely to attend schools in northern New Mexico. These well-educated parents place a high value on their children's schooling in general, and science education in particular. The Laboratory cannot attract or retain the specialized work force it needs if the schools are not up to the standards that the work force demands. Second, recent reports including the Chiles Commission Report state that the development of scientific, engineering, and technical personnel requires education programs that are targeted toward critical skills and that build upon unique Laboratory resources and capabilities.

TOPS was established at the Laboratory in 1991 with the goal to enhance the overall quality of science, mathematics, and technology education in northern New Mexico's classrooms and school districts. This goal was met by

- Increasing teachers' knowledge of physical science, math, and technology;

- Enhancing teachers' skills in teaching science, math, and technology;
- Providing hands-on activities, materials, and training to take back to the classroom;
- Exposing teachers to the application of science, math, and technology to research at a national laboratory; and
- Developing a Web-based communications network, to provide a strong educational support network among program participants and in their own communities.

Throughout its ten-year history the program directly served almost 300 teachers in over 30 different school districts, benefiting thousands of northern New Mexico school children.

Highlights of this Year's Accomplishments

October 1, 2000–September 30, 2001 marked the third of three fiscal years of participation for the cohort of TOPS teachers (Table 23) who joined the program in April 1999. Of the 56 participants who originally enrolled in the program in 1999, 37 stayed in the program until its completion in June 2001.

Twenty-six of the 37 teachers opted to register for credit at the College of Santa Fe, thus earning12 additional hours towards the completion of the 24 required to earn a science endorsement through TOPS participation. Participants received daily stipends for attending the workshops and Summer Institute III as well as tuition, where applicable, and hotel costs.

Three regional workshops were held in November, February, and April/May with two three-hour College of Santa Fe education courses being taught at each: EDU596 – Field Experience I and EDU597 – Field Experience II. Normally the TOPS teachers would only take one three-hour course during the school year, but EDU596 was postponed in FY00 due to funding. The course was made up before the end of FY01 in order for the teachers to meet the 24-hour requirement to receive the science endorsement on NM teaching licenses.

Course Descriptions

EDU596: NM State Department of Education Standards: Theory and Application in the Classroom. This course provided participants in TOPS with the knowledge and tools to develop standards-based units of study based on current curricula.

EDU597: Using WebQuest as a Technology Tool in the Classroom. This course provided participants in TOPS basic instruction and practice in developing standards-based curriculum using the WebQuest strategy. The course focused on integrating the use of computer technology in the science classroom for both research and communication purposes.

The TOPS teachers come from 14 different school districts in 11 different northern New Mexico counties. Over 80% of these teachers are employed in eight school systems where the vast majority (at least 90%) of the student population is Hispanic and/or Native American.

Table 23. TOPS Workshops 2000–2001

Date	Location	Number of Participants
November 3–4, 2000	Four Corners	18
November 17–18, 2000	Los Alamos	26
February 9–10, 2001	Four Corners	12
February 23–24, 2001	Los Alamos	25
April 27–28, 2001	Four Corners	12
May 4–5, 2001	Los Alamos	25

Table 24 is a summary of the demographics of the TOPS teachers themselves:

Summer Institute III. The third and final two-week summer institute was held at the Laboratory on June 11–22, 2001. The curriculum had two main components:

- PHY 402: Applied Modern Physics and Material Science - covered the three nuclear processes (radioactivity, fission, and fusion). Topics of radioactivity covered included kinetics of decay; particles emitted; detection of particles; ability to block particles; and dangers, uses, and sources of radiation. Lab work in radioactivity was conducted. Concepts in fission and fusion included writing equations to represent processes, energy and use in generation of electricity; natural and synthetic production of elements; and historical development of understanding the three processes. This course built upon the material covered in Applied Modern Physics 401 (TOPS 1999, Summer Institute I).

- EDU 595: Curriculum for the Web provided participants with instruction and practice in how to create and edit Web pages, and how to manipulate graphics, sound, and text to deliver content-specific science curriculum on the World Wide Web. Participants also learned methods of navigating the Web in search of science content resources and technology tutorials. Several software titles supporting the course goals were introduced and explored.

In addition to PHY 404 and EDU 595, the teachers attending the summer institute enjoyed a TI-83+ calculator workshop, a robotics workshop and a material science workshop, plus two tours of highly specialized Laboratory facilities—the Trident Laser Facility, and the National High Magnetic Field Laboratory.

Summer Institute III ended with a celebration luncheon and graduation ceremony on June 22 that was well attended by family members of the teachers, representatives from the College of Santa Fe, and Laboratory staff members.

Numerous formative and summative evaluations of workshops and seminars were conducted throughout the course of the TOPS program. At completion of the program, participants were asked to evaluate their overall three-year TOPS experience and reflect on the impact it had on their professional and personal development.

What were your biggest gains from being in TOPS?

- A better understanding of LANL's mission and purpose.
- Technology; knowledge of radioactivity and atomic theory; information to share with students regarding the role of LANL.
- Working on lessons that can be used in the classroom. Acquiring the use of technology and adapting it for use with students.
- The confidence level boost in using computers as a source of information and even as a teaching tool. I know a lot more science than

Table 24. 2000–2001 TOPS Cohort

Ethnicity	Number
African American	1
Caucasian	18
Hispanic	12
Native American	6
Gender	
Female	6
Male	31

I did before I started. Eye opener was dispelling misconceptions students may have.
- Learning about subatomic particles and getting to know the teachers of northern NM.

What were your biggest disappointments about TOPS?

- Didn't last long enough!
- I think there were no disappointments about TOPS. I really enjoyed all of it.
- That it will not continue – I wish more elementary teachers could learn what I have. Thanks for everything!

If TOPS or some version of it were to be funded in the future, what changes would you suggest? What would you hope remains the same?

- The technology component definitely needs to stay. Maybe add more mathematics. The study time this year was great. The availability of the computer classroom after hours was very helpful to completing our projects.
- More AIMS-type activities – that's all I would change – it was really worthwhile!
- Lock in credits at beginning of program.
- I think TOPS was OK in every way. I was hoping it would continue so my son could attend.
- In the future, I hope/suggest that a program such as TOPS continues to fund teachers to purchase computer programs and other teaching materials for their classrooms.

All the teachers expressed a sincere "thank you" to the Department of Energy/Office of Defense Programs for supporting the TOPS program the past ten years and to the Laboratory for its commitment and dedication to make the program the success that it was.